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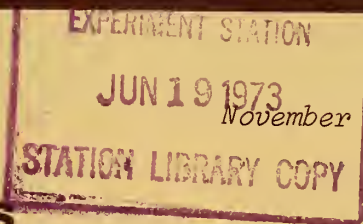




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USDA FOREST SERVICE **RESEARCH NOTE**

PNW-191



**DRY VENEER VOLUME LOSSES
IN PRODUCTION OF
RED AND WHITE FIR PLYWOOD**

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ABSTRACT

Losses of rough, dry veneer between drying and panel trimming expressed as percentages provide a means to estimate output from dryer production volumes. Approximately 16 percent of the dry veneer volume was lost during production of plywood.

Keywords: Veneers (recovery), plywood, *Abies magnifica*, red fir, *Abies concolor*, white fir.

INTRODUCTION

This report presents a method for estimating the loss of dry veneer in manufacturing red and white fir plywood. Loss factors were developed from a volume loss study conducted at a typical veneer mill in northern California peeling red fir (*Abies magnifica* A. Murr.) and white fir (*Abies concolor* (Ford. and Glend.) Lindl.). Volumes used to determine the loss factors were measured at plywood production operations between the veneer dryer and the panel press.

The loss factors developed in this study can be used by the veneer mill production manager to estimate recovery of a known volume of random width strip and half and full sheets of dry veneer from red and white fir. The yield from dry, untrimmed veneer, as measured at the dryer, can be expressed in terms of the final square-foot volume, 3/8-inch basis, that will be available for layup. The losses of veneer volume on a 3/8-inch basis can also be determined at specific stages in panel production. Similar factors have been developed and reported for the manufacture of Douglas-fir veneer in Oregon and Washington.^{1/}

METHOD

Veneer from 983 peeler blocks with diameters ranging from 7 to 47 inches was used in this study. Table 1 presents the number and size of the study blocks by grade. Approximately 418,100 square feet, 3/8-inch basis, of dry untrimmed veneer was produced from these blocks. The peel consisted of three thicknesses: 1/10-inch (138,800 square feet), 1/8-inch (202,400 square feet), and 3/16-inch (76,900 square feet).

After it was peeled, all veneer was processed through normal plywood production channels: drying, reclipping, patching, glue spreading-panel layup, and panel trimming. Recovered volumes and incurred losses at each operation between the dryer and the press were measured and tabulated.

The loss factors shown in table 2 were calculated as follows: All full and half sheets were counted and recorded by veneer grade.

^{1/} Douglas L. Hunt and Richard O. Woodfin, Jr. Estimate of dry veneer volume losses in Douglas-fir plywood manufacture. Portland, Oreg., Pac. Northwest Forest & Range Exp. Stn. USDA Forest Serv. Res. Note PNW-134, 10 p., illus., 1970.

The width of each veneer strip was measured and tabulated by grade. These veneer tallies were later converted to a 3/8-inch thickness basis. All tallies were maintained by cartload lots, equivalent to approximately a 30-inch pile of full sheets. Recovery and loss volumes were determined for each of these loads as they were processed through the various stages of plywood production. Volume losses from these loads of veneer at each stage of production were later combined into a single value from which the loss factor for the entire operation was determined.

Volume loss for each cartload of veneer processed at the glue spreader was determined from the ratio of output to input. The output volume was determined by a count of the untrimmed glue-spread-layers of panel size. This count was converted into total inches of width.

Table 1.--*Number of study blocks by size and grade*^{1/}

Small-end block diameter class (inches)	Blocks by grade				
	1	2	3	4	Cull
7- 9	1	2	29	0	1
10-12	2	9	133	5	0
13-15	5	4	121	23	0
16-18	4	7	87	31	2
19-21	6	7	67	39	0
22-24	5	11	47	30	0
25-27	7	12	37	31	0
28-30	3	8	26	24	0
31-33	6	12	14	19	2
34-36	1	6	16	12	1
37-39	0	7	11	12	0
40-42	3	3	8	6	0
43-45	5	4	2	4	0
46-48	0	2	1	0	0
Total	48	94	599	236	6

^{1/} See "Lumber grade recovery from old-growth white fir on the Sequoia National Forest, California," by H. F. Wise and R. H. May, USDA Forest Serv. Calif. Reg. and Calif. Forest & Range Exp. Stn., Berkeley, 11 p., 1958.

Table 2.--Average loss and recovery factors for dry veneer
at different stages of plywood production

Veneer item and stage of production	Distribution of veneer ^{1/}	Loss factor	Recovery factor	Loss factor, standard error ^{2/}
- - - - -Percent- - - - -				
1/10- and 1/8-inch, D grade, full sheets:				
To reclipping	5.0	--	--	--
To layup	95.0	--	--	--
1/10- and 1/8-inch and A, B, and C grade, full sheets:				
To reclipping	5.0	--	--	--
To patching	95.0	--	--	--
1/10-inch, patched volume:				
To reclipping	4.4	--	--	--
1/8-inch, patched volume:				
To reclipping	3.5	--	--	--
All grades:				
To reclipping	--	14.17	85.83	--
Grades to glue spreader:				
1/8-inch, C grade, half sheets	--	3.16	96.84	2.93
3/16-inch, all grades, half sheets	--	2.32	97.68	1.37
1/10-inch, random width	--	13.62	86.38	2.36
1/8-inch, random width	--	16.31	83.69	3.30
3/16-inch, random width	--	15.35	84.65	3.90
All grades to panel trimming	--	10.54	89.46	--

^{1/} Percentage of veneer sent or returned to a production stage.

^{2/} Standard error is a measure of the variation among sample means.

Actual veneer losses of overhang and discards were tallied in inches of width. Veneer layer overhang is that extending beyond a maximum untrimmed panel size. Discards are veneer sheets too thin or too rough to be used.

LOSS FACTORS

Loss factors were developed for each production step from dryer to press; however, not all veneer grade items incurred losses at each stage. For example, only about 5 percent of the full sheet volume was reclipped (table 2). The remaining 95 percent of the volume of 1/10- and 1/8-inch, grade D veneer went directly to panel layup. The remaining volume of 1/10- and 1/8-inch, grades A, B, and C veneer was sent to the patch line. Approximately 4 percent of the 1/10-inch and 3 percent of the 1/8-inch patched volumes were sent to be reclipped (table 2, and item 6 in tables 4 and 5). The recliipping loss factor of 14.17 percent (table 2) was then applied to the patched-reclipped veneer. It was assumed that none of this veneer would return again to recliipping.

The application of the table 2 loss factors to the study volumes is shown in tables 3, 4, and 5 by veneer item and production stage. Table 3 shows the loss and recovery volumes of full sheets of 1/10- and 1/8-inch grade D veneer after recliipping, glue spreading, and layup. Tables 4 and 5 show the loss and recovery volumes of full sheets of 1/10- and 1/8-inch veneer, respectively, for grades A, B, and C.

Recliipping.--Recliipping losses were determined only for full sheets from tallies of the input to the recliipping operation and the output of usable veneer. The loss factor of 14.17 (i. e., approximately 14 percent--see table 2) was calculated from a ratio of the output to input tallies. Half sheets and random-width strips were not recliipped at this mill. Production equipment did not include an edge jointing and gluing operation.

Glue spreading-panel layup.--From the ratio of output to input at the glue spreader, a loss factor was determined which reflected actual veneer loss by thickness during glue spreading. In table 6, items 3 and 6 give the loss and factors for C grade, 1/8-inch, half sheets and for all grades of 3/16-inch, half sheets sent through the spreaders; in table 7, items 2, 4, and 6 give the loss and factors for 1/10-, and 1/8-, and 3/16-inch, random-width strip and fishtail veneer.

Table 3.--Loss factors^{1/} applied to volume of full sheets
of veneer, 1/10- and 1/8-inch, grade D

Item and loss factor	Veneer volume	
	Recovery	Loss
<i>Square feet, 3/8-inch basis</i>		
(1) Base volume ^{2/}	63,200	--
(2) 5 percent to reclipping	3,160	--
(3) 95 percent to panel layup (item 1 minus item 2)	60,040	--
(4) Reclipping loss on item 2 (14.17 percent x 3,160)	2,712	448
(5) Spreader loss on reclipping (16.31 percent x 2,712)	2,270	442
(6) Volume to layup (item 3 + 5)	62,310	--
(7) Volume loss (item 4 + 5)	--	890

^{1/} Calculated from known square-foot volumes of veneer processed through the various stages of plywood production.

^{2/} The volume of veneer to which loss factors are applied.

Panel trimming.--Untrimmed panel size was approximately 51 by 101 inches. The trimming loss factor was calculated by multiplying the trimmed panel length (96 inches) by its width (48 inches) and then dividing this product by the product of the dimensions of the average untrimmed panel. The average loss was 10.5 percent (i. e., a loss factor of 0.1054, see table 2).

Full sheets of veneer are used in the condition and size they are when stacked out of the veneer dryer or at the patching equipment. The only production loss measured for full sheets was when the laid-up panel was trimmed to finished panel size. Losses from damage caused by poor handling procedures in the plant were not measured as a separate loss. Therefore, the volumes of full sheets were reduced only by the trimming loss.

Table 4.--Loss factors^{1/} applied to volume of full sheets
of veneer, 1/10-inch, grades A, B, and C

Item and loss factor	Veneer volume	
	Recovery	Loss
<i>Square feet, 3/8-inch basis</i>		
(1) Base volume ^{2/}	32,000	--
(2) 5 percent to reclipping	1,600	--
(3) Reclipping loss on item 2 (14.17 percent x 1,600)	1,373	227
(4) Spreader loss on reclipping (13.62 percent x 1,373)	1,186	187
(5) 95 percent of (1) to patch line	30,400	--
(6) Patched volume to reclipping (4.4 percent x 30,400)	1,338	--
(7) Patched volume to layup (item 5 minus item 6)	29,062	--
(8) Reclipping loss on item 6 (14.17 percent x 1,338)	1,148	190
(9) Spreader loss on reclipping (13.62 percent x 1,148)	992	156
(10) Volume to layup (item 4 + 7 + 9)	31,240	--
(11) Volume loss (item 3 + 4 + 8 + 9)	--	760

^{1/} Calculated from known square-foot volume of veneer processed through the various stages of plywood production.

^{2/} The volume of veneer to which loss factors are applied.

Table 5.--Loss factors^{1/} applied to volume of full sheets
of veneer, 1/8-inch, grades A, B, and C

Item and loss factor	Veneer volume	
	Recovery	Loss
<i>Square feet, 3/8-inch basis</i>		
(1) Base volume ^{2/}	46,900	--
(2) 5 percent to reclipping	2,345	--
(3) Reclipping loss on item 2 (14.17 percent x 2,345)	2,013	332
(4) Spreader loss on reclipping (16.31 percent x 2,013)	1,685	328
(5) 95 percent of (1) to patch line	44,555	--
(6) Patched volume to reclipping (3.5 percent x 44,555)	1,559	--
(7) Patched volume to layup (item 5 minus item 6)	42,996	--
(8) Reclipping loss on item 6 (14.17 percent x 1,559)	1,338	221
(9) Spreader loss on reclipping (16.31 percent x 1,338)	1,120	218
(10) Volume to layup (item 4 + 7 + 9)	45,801	--
(11) Volume loss (item 3 + 4 + 5 + 9)	--	1,099

^{1/} Calculated from known square-foot volumes of veneer processed through the various stages of plywood production.

^{2/} The volume of veneer to which loss factors are applied.

Table 6.--Loss factors^{1/} applied to volume of half sheets of veneer

Item and loss factor	Veneer volume	
	Recovery	Loss
<i>Square feet, 3/8-inch basis</i>		
(1) Base volume, ^{2/} 1/10-inch (all grades to layup)	36,800	--
(2) Base volume, 1/8-inch, grade C	3,900	--
(3) 1/8-inch spreader loss (3.16 percent x 3,900)	3,777	123
(4) Base volume, 1/8-inch, grades A, B, and D (all to layup)	47,400	--
(5) Base volume, 3/16-inch, all grades	54,800	--
(6) 3/16-inch spreader loss (2.32 percent x 54,800)	53,529	1,271
(7) Volume to layup (item 1 + 3 + 4 + 6)	141,506	--
(8) Volume loss (item 3 + 6)	--	1,394

^{1/} Calculated from known square-foot volumes of veneer processed through the various stages of plywood production.

^{2/} The volume of veneer to which loss factors are applied.

Table 7.--Loss factors^{1/} applied to volume of random width
(fishtail and strip)

Item and loss factor	Veneer volume	
	Recovery	Loss
<i>Square feet, 3/8-inch basis</i>		
(1) Base volume, ^{2/} 1/10-inch, all grades	45,500	--
(2) 1/10-inch spreader loss (13.62 percent x 45,500)	39,303	6,197
(3) Base volume, 1/8-inch, all grades	65,500	--
(4) 1/8-inch spreader loss (16.31 percent x 65,500)	54,817	10,683
(5) Base volume, 3/16-inch, all grades	22,100	--
(6) 3/16-inch spreader loss (15.35 percent x 22,100)	18,708	3,392
(7) Volume to layup (item 2 + 4 + 6)	112,828	--
(8) Volume loss (item 2 + 4 + 6)	--	20,272

^{1/} Calculated from known square-foot volumes of veneer processed through the various stages of plywood production.

^{2/} The volume of veneer to which loss factors are applied.

Production loss factor.--A single overall loss factor is determined from a ratio of the final output volumes of all veneer by grade and size (as determined by the individual loss factors) to the original input volumes. This factor is 15.8 percent and represents the loss from the total volume of dry, untrimmed veneer tallied at the dry chain to the plywood panel volume at the shipping point. The calculation is illustrated below.

<u>Veneer item and loss factor</u>	<u>Veneer input volumes</u>	<u>Veneer output volumes as determined by loss factors</u>
<i>---Square feet, 3/8-inch basis---</i>		
Random width (strip and fishtail), 1/10-, 1/8-, and 3/16-inch, grades A to D	133,100	112,828
Half sheets, 1/10-, 1/8-, and 3/16-inch, grades A patch to D	142,900	141,506
Full sheets, all grades	142,100	<u>139,351</u>
Untrimmed total to layup	--	393,685
Trimmed total to layup, 393,685 minus panel trimming (10.54 percent x untrimmed total to layup)	<u>--</u>	<u>352,191</u>
Total input	418,100	--
$\frac{352,191}{418,100} = 0.842$	$1.000 - 0.842 = 0.158$ loss factor	

Patch stock in a veneer mill is generally produced from several sources or purchased. The practice at this mill was to use random width, A-grade veneer, 15 inches and wider, for patch stock. Since no veneer of this grade and size was clipped from our study blocks, no loss factors are included for patch stock in this example.

Plywood panel sanding loss was not measured during these tests.

CONCLUSIONS

This study showed that approximately 16 percent of the dry, untrimmed veneer volume in red and white fir plywood production was lost between drying and panel trimming. This result is comparable to that found in similar studies of Douglas-fir, indicating that losses of 16 percent may be generally applicable to this phase of plywood production.

Several uses can be made of the loss and recovery factors reported here. A veneer mill peeling a comparable range of peeler block sizes and grades into similar veneer thicknesses can use these factors to estimate recovery or loss for specific veneer items and production stages.

The loss factors associated with each veneer thickness may offer guidelines to a veneer mill considering a change in thickness of peel or plywood panel composition. Production stages having higher loss factors can be identified. These could then receive the greatest attention for quality control.

A mill interested in determining the extent of its losses at the various processing points can apply these factors or conduct similar tests and compare results with those shown here.

When the study results are used, care should be taken to account for other factors which can affect levels of veneer loss but which were not examined in this study.

Two likely factors which could cause significant variation are low quality logs and any mill inefficiency. Low quality logs produce veneer with defects such as large knots; this generally results in a reduction in the total dry veneer volume recovered because of greater green veneer removal at the clipper. Though these losses may be quite substantial, this particular aspect of veneer production was not investigated for this report. Veneer losses attributable to mill inefficiency are often difficult to separate. For example, lack of control on veneer thickness would result in thick and thin veneer being produced. Such mismanufactured veneer would become apparent at the glue spreader, resulting in an increased loss from discarded veneer at that operation.